CLAIMS

What is claimed is:

1. A neurostimulating lead comprising:

(a) a body member having a length, a proximal end and a distal end;

(b) at least one conductor embedded within said body member and extending the length of the body member;

(c) at least one tunnel extending from an outer surface of the body member to at least one of said conductors;

(d) at least one thin film electrode deposited on said outer surface at the distal end of said body member; and

(e) conductive links extending through said tunnel from at least one of said conductors to at least one of said thin film electrodes.

2. The neurostimulating lead, as in Claim 1, further comprising at least one connector having contacts electrically joined to the conductors at the proximal end of the body member and adapted to connect the lead to a neurostimulator

3. The neurostimulating lead, as in Claim 1, wherein the body member is tubular, having an annular wall defining an internal lumen extending between the proximal end and the distal end with said conductors being spiral wound and embedded in the annular wall.

4. The neurostimulating lead, as in Claim 3, wherein the body member is polyurethane and has an outer diameter of about 2 French and an internal diameter of about 0.012 inch.

5. The neurostimulating lead, as in Claim 4, wherein said conductors have a substantially rectangular cross-section, 0.004 inch wide by 0.002 inch high.

6. The neurostimulating lead, as in Claim 5, wherein said conductors are a metal, wherein the metal is selected from the group of stainless steel, MP35N, titanium, tantalum, tungsten, platinum, or silver.

7. The neurostimulating lead, as in Claim 3, wherein turns of said conductors are longitudinally spaced from each other, each turn being at an angle between about 10 degrees to about 80 degrees from a longitudinal axis of the body member.

8. The neurostimulating lead, as in Claim 7, wherein each of said thin film electrodes spans and is electrically connected by at least one of said links to at least one of the plurality of conductors.

9. The neurostimulating lead, as in Claim 7 wherein each of said thin film electrodes spans and is electrically connected by said links to more than one turn of a given one of said plurality of conductors.

10. The neurostimulating lead, as in Claim 1 wherein the conductive links comprise electroplated conductive links.

11. The neurostimulating lead, as in Claim 10, wherein the electroplated conductive links comprise a metal selected from the group of gold, silver, platinum, platinum-iridium and titanium.

12. The neurostimulating lead, as in Claim 1, wherein the conductive links comprise a conductive epoxy.

13. The neurostimulating lead, as in Claim 1, wherein each of said plurality of electrodes is a ring electrode.

14. The neurostimulating lead, as in Claim 1, wherein said electrodes include first and second electrode segments disposed along a longitudinal dimension of the body member in overlapped relation, said electrode segments adapted to be electrically connected to one of a voltage of positive polarity, a voltage of negative polarity or zero voltage.

15. The neurostimulating lead, as in Claim 10, wherein each of said ring electrodes comprises multiple superposed nanocrystaline metal layers with an innermost layer of a metal selected from the group of titanium, chromium, nickel and aluminum and having a thickness less than about 5 microns, a layer adjacent the innermost layer of a metal selected from the group of lead and platinum and having a thickness between 500 angstroms and 50 microns, the outermost layer of a metal selected from the group of gold, platinum and platinum-iridium and having a thickness between 500 angstroms and 50 microns, and a layer adjacent the outermost layer of a metal selected from the group of gold, platinum, platinum-iridium, silver and copper and having a thickness between 500 angstroms and 50 microns.

16. A method for fabricating a peripheral nerve stimulating lead comprising the steps of:

(a) extruding a body member having a proximal end, a distal end and a wall defining a lumen extending between the proximal end and the distal end;

(b) wrapping at least one conductor about the body member in spaced spiral relation, the conductors extending from the proximal end to a position proximate the distal end;

(c) embedding the conductors in the wall of the body member to electrically insulate the conductors from one another;

(d) boring at least one tunnel in the wall at the position leading to each of the conductors;

(e) providing a conductive link through the tunnels to electrically connect the conductors to an outer surface of the wall; and

(f) depositing at least one thin film electrodes onto said outer surface in longitudinally spaced relation and contacting said conductive paths.

17. The method, as in Claim 16, further comprising attaching an electrical connector to the conductors at the proximal end of the body member.

18. The method, as in Claim 16, wherein providing a conductive link comprises electroplating a metal through the tunnels to electrically couple the conductors to the outer surface of the wall.

19. The method, as in Claim 16, wherein providing a conductive link comprises applying a conductive epoxy through the tunnels to electrically couple the conductors to the outer surface of the wall.

20. The method, as in Claim 16, further comprising providing a guide wire for insertion through the lumen.

21. The method, as in Claim 16, further comprising providing a stylet for insertion through the lumen.

22. The method, as in Claim 16, wherein the body member is polyurethane.

23. The method, as in Claim 16, wherein the extruding yields a body member having an outer diameter in a range of from 0.010 inch to 0.065 inch and an inner diameter in a range of from 0.005 to 0.040 inch.

24. The method, as in Claim 16, wherein the wrapping includes wrapping at least four conductors about the body member.

25. The method, as in Claim 16, wherein the conductors have a rectangular cross-section about 0.004 inch wide and 0.002 inch thick.

26. The method, as in Claim 16, wherein the conductors are formed of a metal selected from the group of stainless steel and MP35N.

27. The method, as in Claim 16, wherein the wrapping further includes wrapping the conductors about the body member at an angle between about 10 degrees to about 80 degrees from a longitudinal axis of the body member.

27. The method, as in Claim 15, wherein depositing includes depositing of layers of differing metals over an area of the outer surface spanning at least one conductive link of a given the conductors.

28. The method, as in Claim 17, wherein electroplating includes connecting said conductors at a proximal end thereof to a DC voltage source and submerging the zone in a plating bath containing ions of a selected metal.

29. The method, as in Claim 15, wherein forming the tunnels includes focusing a laser beam on the surface of the wall at selected locations overlaying portions of the conductors and vaporizing the body member with laser energy at the selected locations to form the tunnels.

30. In a neurostimulating lead of the type comprising an elongated, plastic body member having a proximal end, a distal end and an annular wall defining a lumen, at least one electrode affixed proximate the distal end of the body member and an elongated conductor embedded in the wall of the body member and extending from the proximal end to the distal end of the body member, a method of connecting the conductor to the electrode comprising the steps of:

(a) before forming the electrode on the distal end of the body member, creating a plurality of openings through the wall leading to the embedded conductor;

(b) providing a conductive link through the tunnels to electrically connect the conductors to an outer surface of the wall; and

(c) depositing said electrode on an outer surface of said wall so as to establish electrical contact with the electroplated conductive metal in the openings.

31. The method, as in Claim 30, wherein providing a conductive link comprises electroplating a metal through the tunnels to electrically couple the conductors to the outer surface of the wall.

32. The method, as in Claim 30, wherein providing a conductive link comprises applying a conductive epoxy through the tunnels to electrically couple the conductors to the outer surface of the wall.

33. The method, as in Claim 30, wherein the plurality of openings are created by focusing a laser beam on said exterior surface of the wall and burning through the wall to the embedded conductor.

34. The method, as in Claim 30, wherein electroplating of a conductive metal involves electroplating with a metal selected from the group of gold, silver, platinum, platinum-iridium and titanium.

35. The method, as in Claim 30, wherein depositing the electrodes includes depositing selected metals as multiple superposed nanocrystaline layers with the composite thickness of the resulting electrode being less than about 350 microns.